

than to westward, which enables the slender ends to hang nearer the ground on the east. The twig effect is not unlike that on the maple, but the greater length of the pendulous end twigs takes away the appearance of combing upward on the west side. The tips of the lower limbs on both sides hang directly downward, but toward the top of the tree the effects are almost identical with those observed on the maple. Fig. 3 is an example in twig. A photograph of the same tree from the west is quite symmetrical.

Wind effects may also be noted in the oak, the hickory, the sycamore or buttonwood, and the black walnut. Many tropical trees have their tops one-sided under wind influence, though they are one-sided to south or west instead of to east.

The best trees for observation are those standing alone in an open space, where they are not sheltered from the wind, and where the direction of their growth is not influenced by unequal lighting. Trees tend to grow strongly toward the light, but such observations as have been made seem to justify the statement that light usually has less effect on trees fairly exposed to the wind than the wind does.

These studies may afford a method of determining prevalent winds in regions meteorologically unexplored.



FIG. 4.—Wind effects.

NOTE.—These illustrations have been kindly loaned by the editor of the Journal of Geography, but the numeration has been altered to suit this abstract.

ARGENTINE REPUBLIC WEATHER SERVICE.

The Weather Bureau has recently contributed two men to the meteorological office of the Argentine Republic. These are Mr. L. G. Schultz, who is to take charge of the magnetic service, and Mr. Montrose W. Hayes, Section Director, who goes to the central office, which is now established at Buenos Ayres, and who will probably also have charge of the forecast division. It is a pleasure to realize that there is a demand for men who have gone through the training implied in a long service in the Weather Bureau.

SEISMOLOGICAL WORK.

Under date of March 15 Prof. Dr. J. M. Perntner announces that by order of His Majesty, the Emperor of Austria, the seismological work hitherto supervised by the earthquake committee of the Imperial Academy of Sciences of Vienna will now be undertaken by the K. K. Zentralanstalt, and the official title of this institution is, therefore, changed to read as follows: "K. k. Zentralanstalt für Meteorologie und Geodynamik."

AVERAGES BY MONTHS OR BY SEASONS.

In a recent letter from Prof. Victor Raulin, of Montfaucon d'Argonne, France, who, since the death of Glaisher, is undoubtedly the oldest living meteorologist of Europe, he says:

It is the custom of the meteorologists of Europe, and probably of the whole world, to group the twelve months into four seasons, beginning, respectively, with December, March, June, and September.

It would be very interesting to determine and to mark out precisely each year the regions where droughts or excessive rainfalls prevail. For this purpose it would be necessary to begin by establishing a good average, for example, of twenty years, for a large number of stations in Europe. Then we should have to compare with this average the monthly or seasonal amounts of each of the years that have contributed to form it. By this means we should be able to determine the departures and their direction, and perhaps also to recognize some periodicity.

The question whether the twelve months of the year should be classified according to the meteorological year or the calendar

year is, we think, still open for discussion. The individual months themselves seem to us more important than the four seasons of the year. But the question really depends upon what use we propose to make of the rainfall data. In all parts of the world there are some plants, some animals, some industries and other human interests that depend so closely upon the rainfall that we are continually tempted to make comparisons, in the hope of elucidating the complex relations and possibly discovering some law of importance to mankind.

In all such researches the proper attention to important details requires us to make use of monthly rainfalls instead of seasonal. There are other broader questions, such as the comparison of the local climates in different parts of the world, in which it may be allowable to consider only seasonal averages, but the publication of monthly means is certainly a primary duty, so that each may have the data that he needs in his study. For instance, in different portions of North America seed is sown or planted in different months, ranging from the early spring to the late autumn, and the development of any crop, depending as it does as much on the amount of water stored in the ground as on the current rainfall, requires us to consider the precipitation between certain definite dates, which do not agree with the beginnings of winter, spring, summer, or autumn, but may more appropriately be assumed to coincide with the beginnings of special months. On another page, for instance, we publish a study in local climatology by Mr. Emigh, of Dodge, in which he shows very plainly why monthly means rather than seasonal means must be used for Kansas.

A HAWAIIAN WEATHER BUREAU STATION.

A regular meteorological observation station of the Weather Bureau, under the charge of Mr. Alexander McC. Ashley, formerly local forecaster at Syracuse, N. Y., will be established at Honolulu. This station will be the center of the Hawaiian Climate and Crop Service, and will issue a weekly crop report and a monthly bulletin.

UNIFORMITY IN METHODS AND STANDARDS OF INSTRUCTION IN METEOROLOGY.

Attention has been called to the fact that instruction in meteorology is going on at nearly all the stations of the Weather Bureau. In some cases the observer has only his assistants under instruction; in other cases he gives a course of lectures to classes of high schools, colleges, or universities. It is desirable that in all cases the instruction should be consistent with the best methods of the service, and the best knowledge we have of meteorology. The multitude of official instructions, circular letters, elementary and advanced textbooks issued during the past twenty years leaves opportunity for many sources of discrepancy and uncertainty. It is possible and desirable that uniform methods should be adopted at all stations, and that the instruction given in the college classes should be up to date. The general supervision of this whole subject may eventually be entrusted to some competent official; meanwhile, the editor will be very glad to hear directly from any one in the service who has felt the need of greater educational facilities, or who wishes to contribute his ideas and experience to the improvement of this branch of the work of the service. Those who have given courses of lectures should send in an outline or synopsis of these; those who wish to give courses should state the subjects on which they think lectures should be given; those who have had experience in the instruction of beginners in regular station work can, perhaps, suggest some improvements in this class of work. The need of a general school of instruction; the desirability of calling in the older members of the service, so that they may attend advanced lectures at the Central Office; the need of a special text-book to supplement those of Davis and Waldo;

the need of a general treatise on the more difficult problems in the mechanics of the atmosphere; the outline of a work on the special relations of the climate to the crops: these are among the numerous questions that will bear discussion.

In his recent testimony before the House Committee on Agriculture, January 16, 1904, the Secretary of Agriculture said:

With regard to our educational work I want to call your attention to what we are doing in several States. It has been the theory of the Committee on Agriculture of the House that we should cooperate with the States, and we are doing a good deal of that; in fact, we are doing a great deal of it. We are not only doing that, but we are helping educational institutions throughout the country. Some years ago there was not a lecture delivered anywhere in the United States on meteorology. We have furnished the services of 14 gentlemen to lecture in universities and colleges in the States, for the purpose of having, eventually, scholars in the land along these lines.

I gave instructions to Mr. Moore lately to bring those 14 gentlemen—they are observers in certain localities who incidentally lecture to these colleges and universities (Yale was the last institution that applied for one)—into a summer school in Washington and strengthen their lectures, so that when they go out to entertain classes they can do it with effect, to the end that some of those students in meteorology will find their way here and enable us to do better work some day.

WEATHER FORECASTS BY LOCAL OBSERVERS.

A recent letter from the professor in charge of meteorological observations and instruction at one of our cooperating colleges, and who is also a voluntary observer of the Weather Bureau, after enumerating the instruments and apparatus at his disposal goes on to say:

We have gone to considerable expense, all by hard subscription, to make our equipment sufficient in the study of climatological conditions, and no effort shall be spared to add what may yet be wanting in the magnetic and seismic lines, not to omit the astronomical department, which is well under way.

With the instruments on hand we have already been able to do some local forecasting, which very generally agrees with the forecasts from the Weather Bureau, but which is on the whole more accurate and reliable for our special locality, a fact which the community around begins to recognize. Now, if this observatory can be, over and above mere voluntary observation, of any service to the Weather Bureau, I am sure we will cheerfully place it at your disposal.

The above quotation presents a condition of affairs typical of that at many other institutions in this country. After thirty years of hard work, the Weather Bureau has been able to convince the people that the movements of the broad general features of atmospheric conditions can be forecast, and that too, profitably, by a discreet use of the information displayed upon the daily weather chart. Without this weather chart nothing at all could be done, but with its help one may foresee quite closely in what direction the front of a cold wave or of an area of rain or snow will move. We may often predict from day to day the motions of a whirling center of wind-storm with a high percentage of accuracy, but the occurrence of rain or snow at any locality is a much more difficult matter.

The growing conviction that the atmosphere is subject to the laws of mechanics; that the weather can be predicted from day to day, and that eventually reliable long-range forecasts may be possible, has stimulated thought and research in all directions, and during these thirty years weather bureaus, weather maps, forecasts, and learned meteorologists have sprung up in all parts of the world. In our own country, a solid foundation for future progress is being made by the introduction of the study of meteorology into schools and colleges where it had hitherto been entirely neglected. This is the status of the institution from which the above quoted letter was received. It is doing a splendid work in stimulating the study of the subject, and among its students it will, we hope, raise up some who will be prominent meteorologists in the future. It desires to do forecast work, but it would be anticipating matters by a generation or two to imagine that a single observatory by itself can undertake with success the work of local weather predictions.

It is now a hundred years since the meteorological society at Mannheim finished its work of publishing that collection of daily observations which Brandes used in compiling his daily weather maps. From that time to this it has been evident that it is the combination of many stations into one chart that must be the basis of weather predictions. Only in the case of an isolated island like Mauritius does one feel driven by necessity to base a guarded forecast of an approaching typhoon on the local indications of pressure, wind, and cloud. The local forecasts made by every unofficial forecaster in the United States, so far as we have yet heard of them, depend upon the stars and the cycles, and are utter nonsense, or else they depend upon the daily weather map, and are only slight modifications of, or identical with, the official Weather Bureau forecasts. In fact, the Weather Bureau employs many men who are familiar with the study of weather maps, and it is hardly likely that these will on any given occasion fail to make as good forecasts as anybody else can make from the same data. Our work is open to all, and it is perfectly allowable for anyone to modify our forecasts or make new ones if he chooses for his own personal use, but it is certainly a very ungracious procedure for a man to make forecasts based on our data and then proclaim himself as superior to the Weather Bureau, or lead his community to think that he knows more about the subject than we. Such a course may magnify him in the eyes of his community; may bring funds and support for his college; may increase the circulation of the newspaper that publishes his forecasts; may increase his importance as a popular success, and yet, at the bottom, all his good work must depend upon the same data, rules, and laws that are employed by the Weather Bureau. The success of one forecaster and the failure of another is a matter peculiar to the man, not to the system.

The Weather Bureau is especially interested in having our colleges and universities prepare young men for future meteorological work in the Bureau by drilling them in meteorology and all the branches of physics that bear thereon. Of meteorology we may say something analogous to that recently said by Mr. George A. Damon of electricity; namely:

The leaders in the various branches of the electrical industry during the first developments, when electrical work was an art and not a science, were graduates from the well-known university of "Hard Knocks." The men of the second generation of workers who are now doing things are largely the product of a semiscientific training in schools of technology, supplemented by experience of a practical nature picked up in a more or less haphazard way. A few years more will see the development of a third and better prepared generation of electrical experts, and it is safe to say that they will be the result of a combination of practical training thoroughly mixed with theoretical education. It must be expected that the next generation will be superior to the present one.

NEW ASTROPHYSICAL AND METEOROLOGICAL OBSERVATORIES.

The last number of Gerland's *Beiträge zur Geophysik*, vol. 6, p. 534, contains a short report on the establishment of an astrophysical observatory near Tortosa, in the Province of Tarragona, in eastern Spain (latitude 40° 48' north, longitude 0° 33' east of Greenwich). This observatory consists of a number of separate buildings for the respective instruments and observers that belong to the establishment. The institution is located on a delightful hill which overlooks the beautiful valley of the Ebro, and is, therefore, called the Observatory of the Ebro. The principal object of this establishment will be the study of terrestrial magnetism, considered not only by itself, but especially in relation to other phenomena, such as atmospheric electricity, meteorology, earthquakes, microseismic movements, and solar phenomena. Two buildings will be devoted to magnetic work; one to astronomical and solar work; a fourth to meteorology and atmospheric electricity; a fifth to the continuous register of thunderstorms, the record of earth temperatures, the polarization of sky light,